



# Antimicrobial Use and Resistance (AUR) Option: Protocols and Definitions

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Division of Healthcare Quality Promotion

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# Target Audience



- This training session is designed for those who will collect and analyze Pharmacy or Microbiology data in the Antimicrobial Use and Resistance (AUR) option of the Medication-associated module of the Patient Safety component of NHSN. This may include:
  - NHSN Facility Administrator
  - Patient Safety Primary Contact
  - Infection Control Professional (ICP)
  - Epidemiologist
  - Microbiologist
  - Pharmacist
  - Data entry staff



# Objectives

1. Outline the impact of antimicrobial use and resistance in healthcare
2. Identify the structure and purpose of the AUR option within the Patient Safety Component of NHSN
3. Review the requirements for participation in the AUR option
4. Define location types required in the AUR option



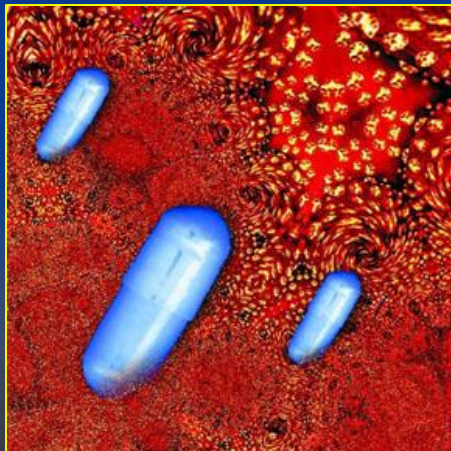
## Objectives (cont.)

5. Describe AUR elements in
  - Monthly Reporting Plan
  - Summary data for Microbiology
  - Summary data for Pharmacy
6. Demonstrate the use of AUR rates to improve infection control practices and antimicrobial prescription practices



# Background

- Antimicrobial-resistant organisms are increasing rapidly in the U.S.
- Reasons:
  - Transmission between patients
  - Selection of resistant organisms because of antimicrobial receipt



<http://www.cdc.gov/ncidod/dhqp/pdf/ar/mdroGuideline2006.pdf>



# AUR Option Purpose

- Assist hospitals in collecting data on antimicrobial use or bacterial resistance to antibiotics or both
- Feedback rates of antimicrobial use and resistance to encourage appropriate antimicrobial prescribing
- Encourage activities targeted toward the prevention of patient-to-patient transmission



**Patient  
Safety  
Component**

**Device  
Associated  
Module**

**DA**

**Central Line-  
associated  
BSI**

**CLABSI**

**Ventilator-  
associated  
Pneumonia**

**VAP**

**Catheter-  
associated  
UTI**

**CAUTI**

**Dialysis  
Incident**

**DI**

**Procedure  
Associated  
Module**

**PA**

**Surgical Site  
Infection**

**SSI**

**Post-  
procedure  
Pneumonia**

**PPP**

**Medication  
Associated  
Module**

**MA**

**Antibiotic  
Use And  
Resistance**

**AUR**



**Medication-  
associated  
Module**

**Antimicrobial Use  
and Resistance  
Option**

**AUR - Microbiology**

**AUR - Pharmacy**



# Requirements

- Collect data for a minimum of 6 months\* per calendar year
- An acceptable month of data includes:
  - Clinical isolates from microbiology or...
  - Antimicrobial agents used from pharmacy or...
  - Both
- Data must be submitted for specific location types within your hospital

**\*Submission of fewer than 6 months will not be adequate to accurately measure antimicrobial resistance or use rates**

# Important Note!



- AUR Option does not collect data about patient infections
- Simultaneous collection of data using the Device-associated Event Module is strongly encouraged for the same months and in the same locations as followed in the AUR Option.

# Monthly Reporting Plan - AUR



- A Plan must be submitted for AUR for each month
- The Plan must include all of the following locations:
  - At least one ICU or SCA
  - All non-ICU/SCA areas combined
  - All outpatient areas combined\*
- For each above area, the facility chooses to monitor either microbiology data or pharmacy data\* or both

**\* Exception** — No pharmacy data are collected in outpatient areas!



# AUR Location Categories

- Intensive Care Unit (ICU): a patient care area that provides intensive observation, diagnosis, and therapeutic procedures for critically ill patients. Excludes step-down, intermediate, or telemetry care.



# AUR Location Categories

- Specialty Care Area (SCA): a patient care area in which 80% of patients are of the following types:
  - Bone marrow/stem cell transplant
  - Solid organ transplant
  - Patients with hematologic or oncologic malignancies
  - Peritoneal or hemodialysis
  - Long term acute care



# Location Definitions for AUR

- All Inpatient (non-ICU/SCA): a designated patient care location category for combining data from all inpatient areas that are not ICU or SCA.
  - The patients in this location are NHSN inpatients (i.e., those patients whose date of admission and discharge are different calendar dates)
  - Data reported as a single entity in AUR option



# Location Definitions for AUR

- All Outpatient: a designated patient care location category which combines the data from all outpatient areas together
  - Patients are admitted and discharged on the same calendar date
  - Data from all outpatient areas combined and reported as a single entity in AUR option
  - Pharmacy data are not reported for outpatients in AUR



# Locations

- AUR Locations are established during the Set Up process
- December 7 training “Facility Start Up”

### Device-Associated Module

Locations

CLA BSI DI VAP CAUTI

SICU - SURGICAL ICU



Add Rows

Clear All Rows

Copy from Previous Month

### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

Microbiology Pharmacy



Add Rows

Clear All Rows

Copy from Previous Month

Save

Back

Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

### Device-Associated Module

Locations

SICU - SURGICAL ICU

CLA BSI DI VAP CAUTI



Add Rows

Clear All Rows

Copy from Previous Month

### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

**If the AUR Option is followed,  
you must monitor**

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

Microbiology Pharmacy



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Copy from Previous Month

Save

Back

Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

### Device-Associated Module

Locations

CLA BSI DI VAP CAUTI

SICU - SURGICAL ICU



Add Rows

Clear All Rows

Copy from Previous Month

### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

**If the AUR Option is followed,  
you must monitor**

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

Microbiology Pharmacy

**SICU – Surgical Critical Care**



Add Rows

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Copy from Previous Month

**At least one ICU or  
SCA**

Save

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Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

### Device-Associated Module

Locations

SICU - SURGICAL ICU

CLA BSI DI VAP CAUTI



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### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

**If the AUR Option is followed,  
you must monitor**

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

**SICU – Surgical Critical Care**



**AIA – All inpatient areas**



Add Rows

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Copy from Previous Month

**All non-ICU/SCA  
inpatient areas  
combined**

Save

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Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

### Device-Associated Module

Locations

CLA BSI DI VAP CAUTI

SICU - SURGICAL ICU



Add Rows

Clear All Rows

Copy from Previous Month

### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

**If the AUR Option is followed,  
you must monitor**

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

Microbiology Pharmacy

**SICU – Surgical Critical Care**



**AIA – All inpatient areas**



**AOA – All outpatient areas**



**All outpatient areas  
combined**

Add Rows

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Copy from Previous Month

Save

Back

Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

### Device-Associated Module

Locations

SICU - SURGICAL ICU

CLA BSI DI VAP CAUTI



Add Rows

Clear All Rows

Copy from Previous Month

### Procedure-Associated Module

Procedures

SSI

Post-procedure  
PNEU

Add Rows

Clear All Rows

Copy from Previous Month

**If the AUR Option is followed,  
you must monitor**

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations

**SICU – Surgical Critical Care**



**AIA – All inpatient areas**



**AOA – All outpatient areas**



**All outpatient areas  
combined**

Add Rows

Clear All Rows

Copy from Previous Month

Save

Back

Local intranet

CDC - Citrix...

Calendar - ...

2006 Webc...

Microsoft P...

NHSN 1.1.1...

Primary Data  
Analysis  
Survey  
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up  
Out

Month\*: October

Year\*: 2006

### Device-Associated Module

Locations	CLA	BSI	DI	VAP	CAUTI
SICU - SURGICAL ICU	X		X	X	
NCC3 - NEONATAL CRITICAL CARE LEVEL III	X		X		

### Procedure-Associated Module

Procedures	SSI	Post-procedure PNEU
CHOL - Gallbladder surgery	BOTH - In and outpatient	
CBGB/CBGC - Coronary artery bypass graft	IN - Inpatient	
KPRO - Knee prosthesis	IN - Inpatient	

### Medication-Associated Module

Antimicrobial Use and Resistance

Locations	Microbiology	Pharmacy
SICU - SURGICAL ICU	X	X
AIA - ALL INPAT AREAS	X	X
AOA - ALL OUTPAT AREAS	X	

Edit

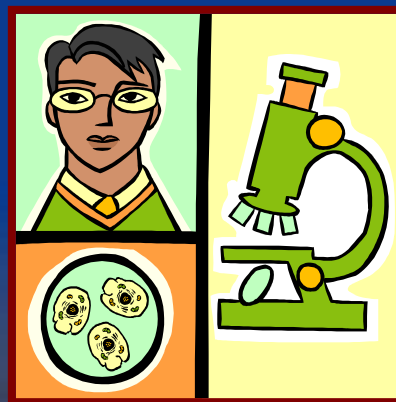
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# AUR – Microbiology Data



# Microbiology Data Collection form



## Antimicrobial Use and Resistance (AUR)

### Microbiology Laboratory Data - Monthly Report Form

OMB No. 0920-0666  
Exp. Date: 02-29-2009

\* required for saving

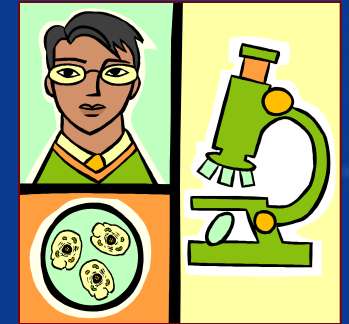
\*Facility ID# :                      \*Month: **Oct**                      \*Year: **2006**                      \*Location Code: **ALLIN**

*Do not report duplicate isolates (i.e., the same patient with the same species) or surveillance cultures*

	Susceptible*	Intermediate*	Resistant*	Total Tested*
<b>GRAM POSITIVE ORGANISMS</b>				
<b>Coagulase-negative staphylococci</b>				
vancomycin				
<b>Enterococcus spp.</b>				
vancomycin				
<b>Staphylococcus aureus</b>				
oxacillin				
vancomycin				
<b>GRAM NEGATIVE ORGANISMS</b>				
<b>Acinetobacter spp.</b>				
amikacin				
cefepime				
ceftazidime				
imipenem				
piperacillin/tazobactam				
ampicillin/sulbactam				
<b>Enterobacter spp.</b>				
cefotaxime				
ceftazidime				
imipenem				
meropenem				
<b>Escherichia coli</b>				
cefotaxime				
ceftazidime				
ciprofloxacin				
imipenem				
<b>Klebsiella pneumoniae</b>				



# Microbiology Data

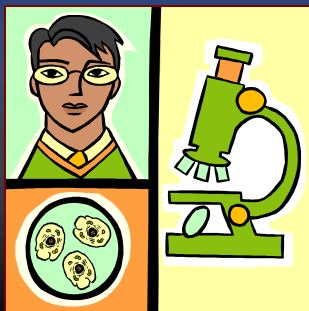


- Report antimicrobial susceptibility test\* results on all nonduplicate, clinical isolates processed by the laboratory during each month of monitoring
  - S – Susceptible
  - I – Intermediate
  - R – Resistant

**\* Defined by Clinical Laboratory Standards Institute (CLSI)**

# Microbiology – Duplicate Isolates

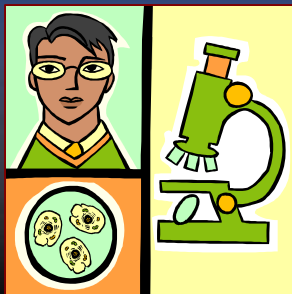
- Do not include duplicate isolates.
  - A duplicate isolate is defined as an isolate of the same bacteria with the same antimicrobial susceptibility pattern in the same patient, regardless of specimen site, during a given calendar month





# Microbiology – Surveillance Cultures

- Do not include surveillance cultures.
  - Surveillance cultures are those cultures reported as part of infection control surveillance such as stool cultures for vancomycin resistant enterococci (VRE) or routine nares screening for MRSA on admission




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http://acid-nhsn-app2:8081/nhsn1.1/addsummarydata.do?method=showpage&navReset=true&currentmenu=menu\_ps\_summ\_add



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Centers for Disease Control and Prevention

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Reporting Plan

Patient

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Procedure

Summary Data

Add

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Facility

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Log Out

Logged into Medical Center East (ID 10000) as MVA.  
Facility Medical Center East (ID 10000) is following PS component.

# Add Patient Safety Summary Data

Summary Data Type: 

Device Associated - Intensive Care Unit / Other Locations

Device Associated - Intensive Care Unit / Other Locations

Device Associated - Neonatal Intensive Care Unit

Device Associated - Specialty Care Area

Device Associated - Outpatient Dialysis - Census Form

Medication Associated - AUR Microbiology Laboratory Data

Medication Associated - AUR Pharmacy Data

Done

Local intranet

Reporting Plan  
 Patient  
 Patient  
 Procedure  
 Primary Data  
 Add  
 Find  
 Analysis  
 Query  
 Reports  
 Facility  
 Setup  
 Logout

## Antimicrobial Use and Resistance (AUR) Microbiology Laboratory Data

Mandatory fields marked with \*

[Print PDF Form](#)

Facility ID\*: 10000 (Medical Center East)

Location Code\*:

Month\*:

Year\*:

Select the appropriate location

Choose the month and year from  
 the drop-down lists

	Susceptible*	Intermediate*	Resistant*	Total Tested*
<b>GRAM POSITIVE ORGANISMS</b>				
<b>CNS - <i>Staphylococcus coagulase negative</i></b>				
VANC - Vancomycin	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>ENTSP - <i>Enterococcus species unspecified</i></b>				
VANC - Vancomycin	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>SA - <i>Staphylococcus aureus</i></b>				
OX - Oxacillin	<input type="text"/>		<input type="text"/>	<input type="text"/>
VANC - Vancomycin	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
<b>GRAM NEGATIVE ORGANISMS</b>				
<b>ACS - <i>Acinetobacter species unspecified</i></b>				
AMK - Amikacin	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
CEFEP - Cefepime	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

## Antimicrobial Use and Resistance (AUR) Microbiology Laboratory Data

Mandatory fields marked with \*

[Print PDF Form](#)

Facility ID\*: 10000 (Medical Center East)

Location Code\*:

Month\*:

Year\*:

	Susceptible*	Intermediate*	Resistant*	Total Tested*
<b>GRAM POSITIVE ORGANISMS</b>				
<i>CNS - Staphylococcus coagulase negative</i>				
VANC - Vancomycin	14	1	24	39
<i>ENTSP - Enterococcus species unspecified</i>				
VANC - Vancomycin	24	11	5	40
<i>SA - Staphylococcus aureus</i>				
OX - Oxacillin	31		11	42
VANC - Vancomycin	40	2	0	42
<b>GRAM NEGATIVE ORGANISMS</b>				
<i>ACS - Acinetobacter species unspecified</i>				
AMK - Amikacin	0	0	0	0
CEFEP - Cefepime	3	1	4	8

## Antimicrobial Use and Resistance (AUR) Microbiology Laboratory Data

Mandatory fields marked with \*

[Print PDF Form](#)

**Facility ID\*:** 10000 (Medical Center East)

**Location Code\*:**

**Month\*:**

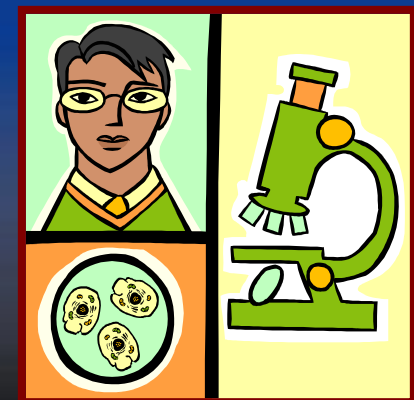
**Year\*:**

	Susceptible*	Intermediate*	Resistant*	Total Tested*
<b>GRAM POSITIVE ORGANISMS</b>				
<i>CNS - Staphylococcus coagulase negative</i>				
VANC - Vancomycin	14	1	24	39
<i>ENTSP - Enterococcus species unspecified</i>				
VANC - Vancomycin	24	11	5	40
<i>SA - Staphylococcus aureus</i>				
OX - Oxacillin	31		11	42
VANC - Vancomycin	40	2	0	42
<b>GRAM NEGATIVE ORGANISMS</b>				
<i>ACS - Acinetobacter species unspecified</i>				
AMK - Amikacin	0	0	0	0
CEFEP - Cefepime	3	1	4	8



# AUR – Microbiology Data

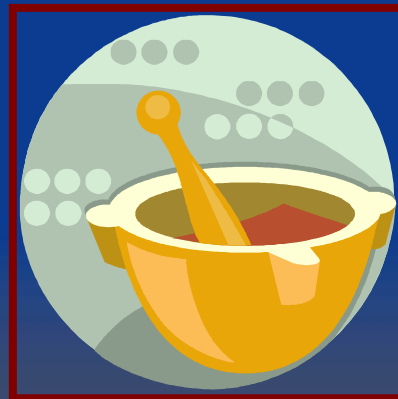
$$\text{Resistance Rate} = \frac{\text{Number of resistant isolates}}{\text{Number of isolates tested}} \times 100$$



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# AUR – Pharmacy Data



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# Pharmacy Data Collection Form



## Antimicrobial Use and Resistance (AUR) Pharmacy Data - Monthly Report Form

OMB No. 0920-0666  
Exp. Date: 02-29-2008

\* required for saving

\*Facility ID# : \*Month: **Oct** \*Year: **2006** \*Location Code: **BMT** \*Patient Days: **633**

Parenteral Antibiotics			
Antibiotic	*Quantity Used†	Antibiotic	*Quantity Used†
amikacin	g	gentamicin	g
ampicillin	g	imipenem	g
<b>ampicillin**/sulbactam</b>	g	levofloxacin	g
azithromycin	g	linezolid	g
aztreonam	g	meropenem	g
cefamandole	g	metronidazole	g
cefazolin	g	moxifloxacin	g
cefepime	g	nafticillin	g
cefmetazole	g	ofloxacin	g
cefotaxime	g	oxacillin	g
cefotetan	g	penicillin G	mill. I.U.
cefoxitin	g	pen. G benzathine	mill. I.U.
ceftazidime	g	procaine pen. G	mill. I.U.
ceftizoxime	g	piperacillin	g
ceftriaxone	g	<b>piperacillin**/tazobactam</b>	g
cefuroxime	g	<b>quinupristin**/dalbapristin</b>	g
cephalothin	g	ticarcillin	g
ciprofloxacin	g	<b>ticarcillin**/clavulanic acid</b>	g
clindamycin	g	tigecycline	g
daptomycin	g	tobramycin	g
ertapenem	g	<b>trimethoprim**/sulfamethoxazole</b>	g
erythromycin	g	vancomycin	g
gatifloxacin	g		
Oral Antibiotics			
Antibiotic	*Quantity Used†	Antibiotic	*Quantity Used†
amoxicillin	g	gatifloxacin	g
<b>amoxicillin**/clavulanic acid</b>	g	levofloxacin	g
ampicillin	g	linezolid	g
azithromycin	g	lomefloxacin	g
cefaclor	g	metronidazole	g
cefadroxil	g	moxifloxacin	g



# Pharmacy Data


- The number of grams or million international units (mill.I.U.) are reported monthly for inpatients
- Selected oral and parenteral antimicrobial agents



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Logged into Medical Center East (ID 10000) as MVA.  
Facility Medical Center East (ID 10000) is following PS component.

## Add Patient Safety Summary Data

Summary Data Type:

- Device Associated - Intensive Care Unit / Other Locations
- Device Associated - Neonatal Intensive Care Unit
- Device Associated - Specialty Care Area
- Device Associated - Outpatient Dialysis - Census Form
- Medication Associated - AUR Microbiology Laboratory Data
- Medication Associated - AUR Pharmacy Data**



NHSN Home  
Reporting Plan  
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Procedure  
Secondary Data

Analysis

Why

Why

at

Logged into Medical Center East (ID 10000) as MVA.  
Facility Medical Center East (ID 10000) is following PS component.

## Antimicrobial Use and Resistance (AUR) Pharmacy Data

Mandatory fields marked with \*

Facility ID\*: 10000 (Medical Center East)

Location Code\*: SICU - SURGICAL ICU

Month\*: October

Year\*: 2006

Total Patient Days\*:

Select the appropriate location

[Print PDF](#)

Choose the month and year from  
the drop-down lists

### Parenteral Antibiotics

Antibiotic	Quantity Used*	Antibiotic	Quantity Used*
AMK - Amikacin	<input type="text"/> g	GATI - Gatifloxacin	<input type="text"/> g
AMP - Ampicillin	<input type="text"/> g	GENT - Gentamicin	<input type="text"/> g
AMPSUL - Ampicillin/sulbactam	<input type="text"/> g	IMI - Imipenem	<input type="text"/> g
AZITH - Azithromycin	<input type="text"/> g	LEVO - Levofloxacin	<input type="text"/> g
AZT - Aztreonam	<input type="text"/> g	LNZ - Linezolid	<input type="text"/> g

Local intranet

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NHSN Home  
Reporting Plan  
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Procedure  
Secondary Data

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Logged into Medical Center East (ID 10000) as MVA.  
Facility Medical Center East (ID 10000) is following PS component.

## Antimicrobial Use and Resistance (AUR) Pharmacy Data

Mandatory fields marked with \*

[Print PDF](#)

Facility ID\*: 10000 (Medical Center East)

Location Code\*:

Month\*:

Year\*:

Total Patient Days\*:

Enter the number of patient days for the location for the month

### Parenteral Antibiotics

Antibiotic	Quantity Used*	Antibiotic	Quantity Used*
AMK - Amikacin	<input type="text"/> g	GATI - Gatifloxacin	<input type="text"/> g
AMP - Ampicillin	<input type="text"/> g	GENT - Gentamicin	<input type="text"/> g
AMPSUL - Ampicillin/sulbactam	<input type="text"/> g	IMI - Imipenem	<input type="text"/> g
AZITH - Azithromycin	<input type="text"/> g	LEVO - Levofloxacin	<input type="text"/> g
AZT - Aztreonam	<input type="text"/> g	LNZ - Linezolid	<input type="text"/> g

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Logged into Medical Center East (ID 10000) as MVA.  
Facility Medical Center East (ID 10000) is following PS component.

## Antimicrobial Use and Resistance (AUR) Pharmacy Data

Mandatory fields marked with \*

[Print PDF](#)

Facility ID\*: 10000 (Medical Center East)

Location Code\*: SICU - SURGICAL ICU

Month\*: October

Year\*: 2006

Total Patient Days\*: 741

### Parenteral Antibiotics

Antibiotic	Quantity Used*	Antibiotic	Quantity Used*
AMK - Amikacin	31.0 g	GATI - Gatifloxacin	0.0 g
AMP - Ampicillin	1338.0 g	GENT - Gentamicin	35.88 g
AMPSUL - Ampicillin/sulbactam	1866.0 g	IMI - Imipenem	169.5 g
AZITH - Azithromycin	78.5 g	LEVO - Levofloxacin	478.5 g
AZT - Aztreonam	44.0 g	LNZ - Linezolid	60.0 g

Local intranet

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4 Citrix ICA Clie...




CEFEP - Cefepime	<b>0.0</b> g	NAF - Nafcillin	<b>825.0</b> g
CEFMET - Cefmetazole	<b>0.0</b> g	OFLOX - Ofloxacin	<b>0.0</b> g
CEFOT - Cefotaxime	<b>0.0</b> g	OX - Oxacillin	<b>0.0</b> g
CTET - Cefotetan	<b>2.0</b> g	PENG - Penicillin G	<b>5922.0</b> mill. I. L
CEFOX - Cefoxitin	<b>0.0</b> g	PENGBZ - Pen. G benzathine	<b>50.8</b> mill. I. L
CEFTAZ - Ceftazidime	<b>477.0</b> g	PROPG - Procaine pen. G	<b>0.0</b> mill. I. L
CEFTIZ - Ceftizoxime	<b>2.0</b> g	PIP - Piperacillin	<b>1082.0</b> g
CEFTRX - Ceftriaxone	<b>1515.6</b> g	PIPTAZ - Piperacillin/tazobactam	<b>10148.0</b> g
CEFUR - Cefuroxime	<b>79.5</b> g	QUIDAL - Quinupristin/dalfopristin	<b>0.0</b> g
CEPH - Cephalothin	<b>0.0</b> g	TICAR - Ticarcillin	<b>0.0</b> g
CIPRO - Ciprofloxacin	<b>8.4</b> g	TICLAV - Ticarcillin/clavulanic acid	<b>90.0</b> g
CLIND - Clindamycin	<b>3026.55</b> g	TOBRA - Tobramycin	<b>12.56</b> g
DAPTO - Daptomycin	<b>0.0</b> g	TMZ - Trimethoprim/sulfamethoxazole	<b>99.2</b> g
ERTA - Ertapenem	<b>18.0</b> g	VANC - Vancomycin	<b>4507.3</b> g
ERYTH - Erythromycin	<b>28.0</b> g		

**Oral Antibiotics**

Antibiotic	Quantity Used*	Antibiotic	Quantity Used*
AMOX - Amoxicillin	<b>50.5</b> g	GATI - Gatifloxacin	<b>0.0</b> g
AMXCLV - Amoxicillin/clavulanic acid	<b>162.275</b> g	LEVO - Levofloxacin	<b>600.5</b> g
AMP - Ampicillin	<b>47.0</b> g	LNZ - Linezolid	<b>77.5</b> g

ERYTH - Erythromycin	<input type="text" value=""/>	g		
<b>Oral Antibiotics</b>				
<b>Antibiotic</b>	<b>Quantity Used*</b>		<b>Antibiotic</b>	<b>Quantity Us</b>
AMOX - Amoxicillin	<input type="text" value="50.5"/>	g	GATI - Gatifloxacin	<input type="text" value="47.0"/>
AMXCLV - Amoxicillin/clavulanic acid	<input type="text" value="162.275"/>	g	LEVO - Levofloxacin	<input type="text" value="600.5"/>
AMP - Ampicillin	<input type="text" value="47.0"/>	g	LNZ - Linezolid	<input type="text" value="77.5"/>
AZITH - Azithromycin	<input type="text" value="112.8"/>	g	LOMEF - Lomefloxacin	<input type="text" value="0.0"/>
CEFAC - Cefaclor	<input type="text" value="151.0"/>	g	METRO - Metronidazole	<input type="text" value="717.5"/>
CEFAD - Cefadroxil	<input type="text" value="0.0"/>	g	MOXI - Moxifloxacin	<input type="text" value="0.0"/>
CEFIX - Cefixime	<input type="text" value="0.0"/>	g	NOR - Norfloxacin	<input type="text" value="0.0"/>
CEFPRO - Cefprozil	<input type="text" value="0.0"/>	g	OFLOX - Ofloxacin	<input type="text" value="0.0"/>
CEPHLX - Cephalexin	<input type="text" value="200.50"/>	g	PENV - Penicillin V	<input type="text" value="5.5"/>
CIPRO - Ciprofloxacin	<input type="text" value="83.5"/>	g	SPAR - Sparfloxacin	<input type="text" value="0.0"/>
CLARTH - Clarithromycin	<input type="text" value="181.25"/>	g	TELITH - Telithromycin	<input type="text" value="0.0"/>
CLIND - Clindamycin	<input type="text" value="65.60"/>	g	TETRA - Tetracycline	<input type="text" value="199.0"/>
DICLOX - Dicloxacillin	<input type="text" value="25.5"/>	g	TMZ - Trimethoprim/sulfamethoxazole	<input type="text" value="381.526"/>
DOXY - Doxycycline	<input type="text" value="190.3"/>	g	VANC - Vancomycin	<input type="text" value="0.0"/>
ERYTH - Erythromycin	<input type="text" value="45.75"/>	g		





# Calculating Antimicrobial Use Rates



$$\text{DDD per 1000 pt. days} = \frac{\text{DDD of antimicrobial}}{\text{\# Patient days}}$$

$$\text{DDD of antimicrobial} = \frac{\text{Grams of antimicrobial used}}{\text{DDD in grams}^*}$$

\* See Table 15 in NHSN Users Manual

<http://www.cdc.gov/ncidod/hip/nhsn/members/PSProtocolsMay06.pdf>

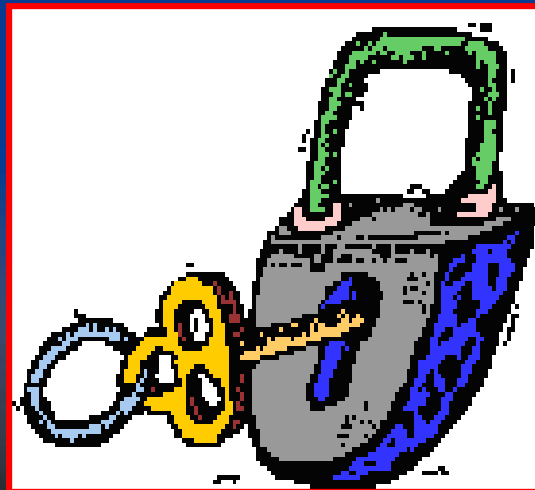


**Table 15 Defined daily dose (DDD) of antimicrobial agents, by class and group**

Class	Group	Antimicrobial Agent	DDD
β-lactams	Penicillin group	Penicillin G	$1.2 \times 10^6$ U*
		Procaine Penicillin G	$2.4 \times 10^6$ U*
		Penicillin G benzathine	$1.2 \times 10^6$ U*
	Ampicillin group	Penicillin V	1 g*
		Ampicillin (parenteral)	2g
		Ampicillin (oral)	2g
		Ampicillin/sulbactam	2g
		Amoxicillin (oral)	1g
	Antistaphylococcal penicillins (Methicillin group)	Amoxicillin/Clavulanic Acid (oral)	1g
		Nafcillin	4g*
		Oxacillin	2g
	Antipseudomonal penicillins	Dicloxacillin (oral)	2g
		Piperacillin	14g
		Piperacillin/Tazobactam	14g
		Ticarcillin	15g
	1st-Generation cephalosporins	Ticarcillin/Clavulanic Acid	15g
		Cefazolin	3g
		Cephalothin	4g
		Cefadroxil (oral)	2g
		Cephalexin (oral)	2g
	2nd-Generation cephalosporins	Cefotetan	4g
		Cefmetazole	4g*
		Cefoxitin	6g
		Cefuroxime	3g
		Cefuroxime axetil (oral)	1g*
		Cefaclor (oral)	1g
		Cefprozil (oral)	1g
	3rd-Generation cephalosporins	Cefotaxime	4g
		Ceftazidime	4g
		Ceftizoxime	4g
		Ceftriaxone	2g
		Cefixime (oral)	0.4g
		Cefipime	2g
	Carbapenems	Meropenem	2g
		Imipenem cilastatin	2g



# Using AUR Rates to Improve Practices



**Table 10.** Pooled means and percentiles of the distribution of antimicrobial resistance rates\*, by all ICUs combined, non-ICU inpatient units and by outpatients, ICARE/AUR, January 1998 through June 2004

All ICUs combined				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
MRSA	157	22,899	52.90	20.0	32.7	48.1	60.3	67.9
Methicillin-resistant CNS	141	13,553	76.60	57.0	69.4	76.3	83.8	88.4
Vancomycin-resistant <i>Enterococcus</i> spp	140	14,140	13.90	0	5	13.6	24.3	39.2
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	134	13,473	34.80	8.3	17.4	29.3	41.3	51.6
Levofloxacin-resistant <i>P aeruginosa</i>	68	5895	35.30	9.7	18.2	29.1	40.8	47.7
Imipenem-resistant <i>P aeruginosa</i>	123	11,986	19.10	4.8	8.3	13.2	25.5	38
Ceftazidime-resistant <i>P aeruginosa</i>	129	12,805	13.90	0	5	10.8	16.9	23.6
Piperacillin-resistant <i>P aeruginosa</i>	118	11,640	17.50	2.4	7.5	14.3	19.5	31.4
Cef3-resistant <i>Enterobacter</i> spp	111	5328	27.70	10.0	17.4	26.1	36.4	47.4
Carbapenem-resistant <i>Enterobacter</i> spp	93	4663	0.70	0	0	0	0	3.8
Cef3-resistant <i>Klebsiella pneumoniae</i>	119	7529	6.20	0	0	2.0	8.0	20.7
Cef3-resistant <i>Escherichia coli</i>	140	12,011	1.30	0	0	0	2.6	6.5
Quinolone-resistant <i>E coli</i>	136	11,776	7.30	0	0	3.3	8.2	19.4
Penicillin-resistant pneumococci	46	1331	18.90	0	5.3	13	24.0	50.0
Cefotaxime/ceftriaxone-resistant pneumococci	33	854	7.50	0	0	3.4	9.6	28.0
Non-ICU Inpatient Areas				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
MRSA	56	42,502	46.00	25.6	31.9	44.9	52.0	60.8
Methicillin-resistant CNS	53	23,525	65.70	52.2	57.1	65.2	71.1	75.9
Vancomycin-resistant <i>Enterococcus</i> spp	55	32,924	12.00	1.9	3.5	7.1	14.2	18.6
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	55	21,302	27.70	13	20.5	27.4	36.8	40.6
Levofloxacin-resistant <i>P aeruginosa</i>	30	10,077	30.50	15.6	21.8	28.7	33.3	44.1
Imipenem-resistant <i>P aeruginosa</i>	53	17,142	12.30	5.6	6.8	10.0	14.4	20.6
Ceftazidime-resistant <i>P aeruginosa</i>	53	19,587	8.80	1.9	4.0	7.0	11.0	14.1
Piperacillin-resistant <i>P aeruginosa</i>	53	16,828	11.60	3.4	6.5	9.2	14.0	18.3
Cef3-resistant <i>Enterobacter</i> spp	50	7509	21.00	7.7	13.9	20.7	25.7	30.9
Carbapenem-resistant <i>Enterobacter</i> spp	46	5976	1.00	0	0	0	1.2	3.2
Cef3-resistant <i>Klebsiella pneumoniae</i>	55	14,204	5.80	0	0.2	1.5	4.4	14.5
Cef3-resistant <i>Escherichia coli</i>	55	40,751	1.50	0	0	0.6	1.7	3.2
Quinolone-resistant <i>E coli</i>	56	40,694	8.20	0.4	1.8	3.6	7.0	18.9
Penicillin-resistant pneumococci	41	3629	18.20	2.6	5.9	12.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococci	34	2148	7.60	0	0.9	5.2	10.5	16.3

**Table 10.** Pooled means and percentiles of the distribution of antimicrobial resistance rates\*, by all ICUs combined, non-ICU inpatient units and by outpatients, ICARE/AUR, January 1998 through June 2004

All ICUs combined				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
MRSA	157	22,899	52.90	20.0	32.7	48.1	60.3	67.9
Methicillin-resistant CNS	141	13,553	76.60	57.0	69.4	76.3	83.8	88.4
Vancomycin-resistant <i>Enterococcus</i> spp	140	14,545	24.3				24.3	39.2
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	134	13,545	41.3				41.3	51.6
Levofloxacin-resistant <i>P aeruginosa</i>	68	5,545	40.8				40.8	47.7
Imipenem-resistant <i>P aeruginosa</i>	123	11,545	25.5				25.5	38
Ceftazidime-resistant <i>P aeruginosa</i>	129	12,545	16.9				16.9	23.6
Piperacillin-resistant <i>P aeruginosa</i>	118	11,640	17.50	2.4	7.5	14.3	19.5	31.4
Cef3-resistant <i>Enterobacter</i> spp	111	5328	27.70	10.0	17.4	26.1	36.4	47.4
Carbapenem-resistant <i>Enterobacter</i> spp	93	4663	0.70	0	0	0	0	3.8
Cef3-resistant <i>Klebsiella pneumoniae</i>	119	7529	6.20	0	0	2.0	8.0	20.7
Cef3-resistant <i>Escherichia coli</i>	140	12,011	1.30	0	0	0	2.6	6.5
Quinolone-resistant <i>E coli</i>	136	11,776	7.30	0	0	3.3	8.2	19.4
Penicillin-resistant pneumococci	46	1331	18.90	0	5.3	13	24.0	50.0
Cefotaxime/ceftriaxone-resistant pneumococci	33	854	7.50	0	0	3.4	9.6	28.0
Non-ICU Inpatient Areas				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
MRSA	56	42,502	46.00	25.6	31.9	44.9	52.0	60.8
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Vancomycin-resistant <i>Enterococcus</i> spp	55	32,924	12.00	1.9	3.5	7.1	14.2	18.6
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	55	21,302	27.70	13	20.5	27.4	36.8	40.6
Levofloxacin-resistant <i>P aeruginosa</i>	30	10,077	30.50	15.6	21.8	28.7	33.3	44.1
Imipenem-resistant <i>P aeruginosa</i>	53	17,142	12.30	5.6	6.8	10.0	14.4	20.6
Ceftazidime-resistant <i>P aeruginosa</i>	53	19,587	8.80	1.9	4.0	7.0	11.0	14.1
Piperacillin-resistant <i>P aeruginosa</i>	53	16,828	11.60	3.4	6.5	9.2	14.0	18.3
Cef3-resistant <i>Enterobacter</i> spp	50	7509	21.00	7.7	13.9	20.7	25.7	30.9
Carbapenem-resistant <i>Enterobacter</i> spp	46	5976	1.00	0	0	0	1.2	3.2
Cef3-resistant <i>Klebsiella pneumoniae</i>	55	14,204	5.80	0	0.2	1.5	4.4	14.5
Cef3-resistant <i>Escherichia coli</i>	55	40,751	1.50	0	0	0.6	1.7	3.2
Quinolone-resistant <i>E coli</i>	56	40,694	8.20	0.4	1.8	3.6	7.0	18.9
Penicillin-resistant pneumococci	41	3629	18.20	2.6	5.9	12.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococci	34	2148	7.60	0	0.9	5.2	10.5	16.3

Facility location category

**Table 10.** Pooled means and percentiles of the distribution of antimicrobial resistance rates\*, by all ICUs combined, non-ICU inpatient units and by outpatients, ICARE/AUR, January 1998 through June 2004

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Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	134	13,473	34.80	8.3	17.4	29.3	41.3	51.6
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Ceftazidime-resistant <i>P aeruginosa</i>	129	12,805	13.90	0	5	10.8	16.9	23.6
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Cef3-resistant <i>Escherichia coli</i>	140	12,011	7.30	0	0	3.3	8.2	19.4
Quinolone-resistant <i>E coli</i>	136	11,776	18.90	0	5.3	13	24.0	50.0
Penicillin-resistant pneumococci	46	1331	7.50	0	0	3.4	9.6	28.0
Cefotaxime/ceftriaxone-resistant pneumococci	33	854						
Non-ICU Inpatient Areas				Percentile				
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MRSA	56	42,502	46.00	25.6	31.9	44.9	52.0	60.8
Methicillin-resistant CNS	53	23,525	65.70	52.2	57.1	65.2	71.1	75.9
Vancomycin-resistant <i>Enterococcus</i> spp	58	32,924	12.00	1.9	3.5	7.1	14.2	18.6
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	55	21,302	27.70	13	20.5	27.4	36.8	40.6
Levofloxacin-resistant <i>P aeruginosa</i>	30	10,077	30.50	15.6	21.8	28.7	33.3	44.1
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Carbapenem-resistant <i>Enterobacter</i> spp	46	5976	1.00	0	0	0	1.2	3.2
Cef3-resistant <i>Klebsiella pneumoniae</i>	55	14,204	5.80	0	0.2	1.5	4.4	14.5
Cef3-resistant <i>Escherichia coli</i>	55	40,751	1.50	0	0	0.6	1.7	3.2
Quinolone-resistant <i>E coli</i>	56	40,694	8.20	0.4	1.8	3.6	7.0	18.9
Penicillin-resistant pneumococci	41	3629	18.20	2.6	5.9	12.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococci	34	2148	7.60	0	0.9	5.2	10.5	16.3

**Bug-drug combination**

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Imipenem-resistant <i>P aeruginosa</i>	123	11,986	19.10	4.8	8.3	13.2	25.5	38
Ceftazidime-resistant <i>P aeruginosa</i>	129	12,805	13.90	0	5	10.8	16.9	23.6
Piperacillin-resistant <i>P aeruginosa</i>	118	11,640	17.50	2.4	7.5	14.3	19.5	31.4
Cef3-resistant <i>Enterobacter</i> spp	111	5328	27.70	10.0	17.4	26.1	36.4	47.4
Carbapenem-resistant <i>Enterobacter</i> spp	93	4663	0.70	0	0	0	0	3.8
Cef3-resistant <i>Klebsiella pneumoniae</i>	119	7529	6.20	0	0	2.0	8.0	20.7
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Levofloxacin-resistant <i>P aeruginosa</i>	30	10,077	30.50	15.6	2	15.6	2	1
Imipenem-resistant <i>P aeruginosa</i>	53	17,142	12.30	5.6	5.6	5.6	5.6	6
Ceftazidime-resistant <i>P aeruginosa</i>	53	19,587	8.80	1.9	1.9	1.9	1.9	1.1
Piperacillin-resistant <i>P aeruginosa</i>	53	16,828	11.60	3.4	6.5	9.2	14.0	18.3
Cef3-resistant <i>Enterobacter</i> spp	50	7509	21.00	7.7	13.9	20.7	25.7	30.9
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Cef3-resistant <i>Escherichia coli</i>	55	40,751	1.50	0	0	0.6	1.7	3.2
Quinolone-resistant <i>E coli</i>	56	40,694	8.20	0.4	1.8	3.6	7.0	18.9
Penicillin-resistant pneumococci	41	3629	18.20	2.6	5.9	12.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococci	34	2148	7.50	0	0.9	5.2	10.5	16.3

Comparative rates

**Table 10.** Pooled means and percentiles of the distribution of antimicrobial resistance rates\*, by all ICUs combined, non-ICU inpatient units and by outpatients, ICARE/AUR, January 1998 through June 2004

All ICUs combined				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
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Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	134	13,473	34.80	8.3	17.4	29.3	41.3	51.6
Levofloxacin-resistant <i>P aeruginosa</i>	68	5895	35.30	9.7	18.2	29.1	40.8	47.7
Imipenem-resistant <i>P aeruginosa</i>	123	11,986	19.10	4.8	8.3	13.2	25.5	38
Ceftazidime-resistant <i>P aeruginosa</i>	129	12,805	13.90	0	5	10.8	16.9	23.6
Piperacillin-resistant <i>P aeruginosa</i>	118	11,640	17.50	2.4	7.5	14.3	19.5	31.4
Cef3-resistant <i>Enterobacter</i> spp	111	5328	27.70	10.0	17.4	26.1	36.4	47.4
Carbapenem-resistant <i>Enterobacter</i> spp	93	4663	0.70	0	0	0	0	3.8
Cef3-resistant <i>Klebsiella pneumoniae</i>	119	7529	6.20	0	0	2.0	8.0	20.7
Cef3-resistant <i>Escherichia coli</i>	140	12,011	1.30	0	0	0	2.6	6.5
Quinolone-resistant <i>E coli</i>	136	11,776	7.30	0	0	3.3	8.2	19.4
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Non-ICU Inpatient Areas				Percentile				
Antimicrobial-resistant pathogen	No. units	No. tested	Pooled mean	10%	25%	50% (median)	75%	90%
MRSA	56	42,502	46.00	25.6	31.9	44.9	52.0	60.8
Methicillin-resistant CNS	53	23,525	65.70	52.2	57.1	65.2	71.1	75.9
Vancomycin-resistant <i>Enterococcus</i> spp	55	32,924	12.00	1.9	3.5	7.1	14.2	18.6
Ciprofloxacin/ofloxacin-resistant <i>Pseudomonas aeruginosa</i>	55	21,302	27.70	13	20.5	27.4	36.8	40.6
Levofloxacin-resistant <i>P aeruginosa</i>	30	10,077	30.50	15.6	21.8	28.7	33.3	44.1
Imipenem-resistant <i>P aeruginosa</i>	53	17,142	12.30	5.6	6.8	10.0	14.4	20.6
Ceftazidime-resistant <i>P aeruginosa</i>	53	19,587	8.80	1.9	4.0	7.0	11.0	14.1
Piperacillin-resistant <i>P aeruginosa</i>	53	16,828	11.60	3.4	6.5	9.2	14.0	18.3
Cef3-resistant <i>Enterobacter</i> spp	50	7509	21.00	7.7	13.9	20.7	25.7	30.9
Carbapenem-resistant <i>Enterobacter</i> spp	46	5976	1.00	0	0	0	1.2	3.2
Cef3-resistant <i>Klebsiella pneumoniae</i>	55	14,204	5.80	0	0.2	1.5	4.4	14.5
Cef3-resistant <i>Escherichia coli</i>	55	40,751	1.50	0	0	0.6	1.7	3.2
Quinolone-resistant <i>E coli</i>	56	40,694	8.20	0.4	1.8	3.6	7.0	18.9
Penicillin-resistant pneumococci	41	3629	18.20	2.6	5.9	12.0	20.0	31.8
Cefotaxime/ceftriaxone-resistant pneumococci	34	2148	7.60	0	0.9	5.2	10.5	16.3

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Ampicillin group	1,899,047	152.1	83.2	111.1	141.7	186.3	266.9
Antipseudomonal penicillins	251,036	20.1	3.1	8.1	16.4	29.0	42.9
Antistaphylococcal penicillins	245,777	19.7	2.9	5.1	12.5	24.2	35.8
First-generation cephalosporins	982,573	78.7	43.9	57.4	76.1	106.6	125.1
Second-generation cephalosporins	368,970	29.6	10.3	16.5	25.3	41.5	54.9
Third-generation cephalosporins	793,340	63.5	21.9	32.2	53.6	79.5	92.5
Carbapenem group	85,779	6.9	0.4	1.8	4.7	9.4	17.1
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First-generation cephalosporins	6978	50.0	9.0	27.7	36.5	54.4	104.9
Second-generation cephalosporins	4286	30.7	1.5	7.1	19.8	32.5	42.4
Third-generation cephalosporins	12,540	89.8	25.1	32.8	73.5	98.0	143.5
Carbapenem group	1635	11.7	0.0	0.2	6.1	12.1	27.4
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Agents with similar spectrum are grouped

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Number of DDD reported

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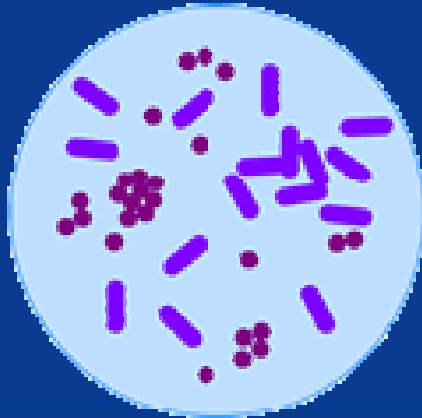
**Pooled mean for each antimicrobial agent group**

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# Using the Data



- Detect emergence of new resistant organisms or changes in resistance patterns in your facility
- Identify changes that may correlate with
  - Staffing changes
  - Staff education
  - Antibiotic prescribing practices
- Compare your rates with NHSN rates



# Using the Data

- Helpful in getting administrative support for infection control intervention activities
- Correlate data with pathogens identified in infections (e.g., VRE increasing rates and increasing incidence of CLABSI with VRE pathogen)



# Using the Data

- Provide clinicians with information to guide antimicrobial prescribing practices





# Questions?

[http://www.cdc.gov/ncidod/dhqp/nhsn\\_members.html](http://www.cdc.gov/ncidod/dhqp/nhsn_members.html)

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